

Dependence of Heavy Element Abundances on First Ionization Potential in Small Solar Energetic Particle Events

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Using the Solar Isotope Spectrometer on the Advanced Composition Explorer, we have measured the ~ 10 – 20 MeV/nucleon heavy ($Z \geq 6$) element abundances of ~ 30 small solar energetic particle (SEP) events which occurred between 3 April 1998 and the present. Average O fluxes during the small events were between 6×10^{-7} and 7×10^{-6} (s sr cm² MeV/nuc)⁻¹. We have classified the events according to their ~ 4.5 – 5.5 MeV/nucleon $^3\text{He}/^4\text{He}$ ratios and have compared their average heavy element composition with that of past studies, obtaining good agreement. We have also examined each SEP event for a dependence of abundances relative to those of the solar photosphere on first ionization potential (FIP). We find a statistically significant FIP effect in virtually all of the small SEP events, including those which are ^3He -rich and have heavy element abundances typical of impulsive SEP events. This research was supported by NASA at Caltech (under grant NAG5-6912), JPL, and GSFC.